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PRELIMINARY DESCRIPTION OF A NEW SUBORDER OF PHYTOSAURIAN REPTILES WITH A DESCRIPTION OF A NEW SPECIES OF *PHYTOSAURUS*

E. C. CASE
University of Michigan, Ann Arbor

The Triassic beds exposed in a narrow strip along the eastern edge of the Staked Plains in western Texas have not been intensively studied and are now grouped together under the name given by Drake, the Dockum beds. Drake recognized an indefinite tripartite division of the beds which may later be distinguished as recognizable horizons. The vertebrate remains which have so far been recovered from these exposures are all members of the reptilian order Parasuchia and of the stereospondylus stegocephalia and are indicative of an upper Triassic age. Summary accounts of the reptilian forms previously described have been given by McGregor and Mehl.[1]

In the year 1917 the author, while on a hurried trip across the plains, found near the now little used crossing of the Blanco or Catfish River on the road from Spur, in Dickens County to Crosbytown, in Crosby County, a series of vertebrae, with portions of the dorsal armor, of a reptile which appeared to be of the usual phytosaurian type and were referred, in the museum catalogue, to *Phytosaurus buceros* Cope with question. In 1919 a chance was afforded to revisit the locality and considerably more of the same specimen was recovered. The material now in hand includes most of the vertebral column with exception of the posterior part of the tail, much of the dorsal armor and the skull, lacking the anterior end of the nose and the lower jaws. The skeleton was found in a sandy clay mixed with abundant fragments of vegetation and the bones were coated with a tough layer of gypsum which has in places penetrated and rotted the bones and in other places left them in singularly good condition. The bones were disturbed when deposited so that only a few of the cervical and of the dorsal vertebrae were found in series. That the bones are those of a single individual is indicated by the fact that they were found in a single mass and that no other bones were found, even after a careful search, within a half-mile of the small patch where they were found, but that there is some room for doubt is indicated by the fact that it seems impossible to fit two of the isolated cervicals into the series and that there are more dorsals than are usually found in the Parasuchia. These points are significant because the skull and the dorsal armor are so radically different from any form yet found while the vertebrae are typically Parasuchian. If, though it seems impossible at present, the remains are finally shown to belong to more than one individual, the skull must remain the type of the new sub-order and the vertebrae and dorsal armor must be described separately as a new form.

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[1] J. H. McGregor, *Mem. Am. Mus. Nat. Hist.*, Vol. IX, Part XI, 1906; M. G. Mehl, *Jour. Geol.*, Vol. XXIII (1915), p. 129.

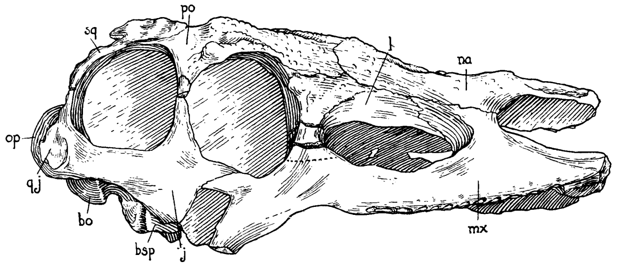

FIG. 1.—Lateral view of the skull of *Desmatosuchus spurensis*, ×¼

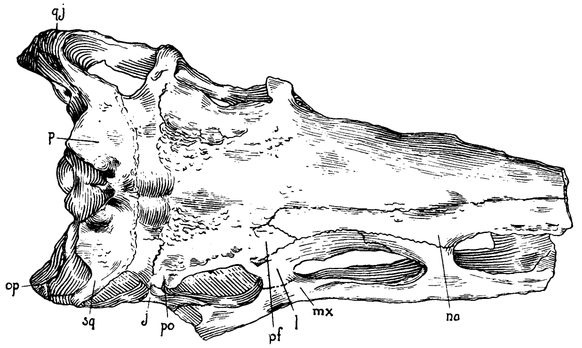

FIG. 2.—Upper view of the skull of *Desmatosuchus spurensis*, ×¼

The character of the skull is shown in Figures 1, 2, and 3. It is astonishingly small for the size indicated by the vertebral column. The basi-cranial region is distinctly phytosaurian in size and the arrangement of the elements but the skull as a whole shows several marked peculiarities. There is a single large lateral temporal fenestra with no trace of an incipient or disappearing upper fenestra. The quadrate is so far reduced that it occupies a depression bounded by the opisthotic and the quadrato-jugal (?); the large, laterally directed orbits are preceded by large, elongate antorbital vacuities and these by smaller, elongate narial openings which lie entirely on the side of the nose; the teeth are small (as indicated by the sockets and a single poorly preserved tooth), are of equal size throughout the length of the maxillary, and were set in deep sockets; the posterior surface of the skull is completely closed except for the large foramen magnum and two small openings, amounting only to foramina, which occupy the position of the posterior temporal openings.

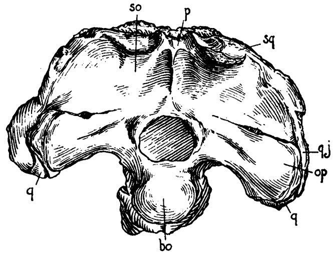

FIG. 3.—Posterior view of the skull of *Desmatosuchus spurensis*, ×¼

The anterior end of the skull is missing but there is every indication that the nose was short. The close anchylosis of the bones and the coarse sculpture of the upper surface of the skull prevents the determination of many of the sutures; such as have been located are indicated upon the figures. As it has been shown by v. Huene and others that *Aëtosaurus* possessed upper temporal openings and as such openings are present in the Proterosuchia, their absence in the form here described is alone sufficient to indicate its isolated position.

The vertebral column so closely approaches that of the Parasuchia that it need not be discussed in a preliminary description.

The dorsal armor consists of four rows of plates, two on each side of the median line. The rows are made up of incomplete rings covering the dorsal portion of the body. Whether there was any armor on the sides or the abdomen is uncertain; a single small plate of irregular form such as occurs on the lower part of the body of the Parasuchia was found with the specimen but its position is uncertain.

The dorsal armor is most conveniently described as a series of transverse arches. The first five are not metamerically arranged with relation to the vertebrae; they cover the first ten vertebrae, rather more than the whole cervical series; posterior to this the plates correspond in number and position with the vertebral segments below. Each arch consists of a pair of median plates with a low blunt spine or knob, and a pair of outer plates which carry spines of varying size and form. The plates of the first five arches have only a slight sculpture, those posterior to the fifth have an increasingly heavy sculpture of pits and ridges which soon becomes very coarse. The form of the various plates is shown in Figure 4, which is a semi-diagrammatic restoration of the dorsal armor. Except for the three posterior dorsal arches and the median caudals there is evidence for all the parts. The arrangement of the plates is such as is dictated by the form and characters of the units, none having been found in sequence posterior to the cervical region.

The first five arches show a gradual increase in the size of median plates and a rapid increase in the size of the spines upon the lateral plates. In the fourth arch the median and lateral plates of the right side are co-ossified and in the fifth arch the median plates of both sides and the lateral plate of the left side fit well together; in these arches there can be no doubt of the position and direction of the spines and by analogy with these the position of the other plates and spines is determinable. The fifth arch is most astonishing in the development of the relatively enormous spines which extend outward almost horizontally and curve forward over the third and fourth arches. In all of the arches of the cervical region the plates are thickened at the point of juncture in the same arch and thinned anteriorly and posteriorly to permit of the overlapping from before backward and allow for slight vertical movement of the head and neck; any lateral movement, as indicated by the form of the plates and the faces of the vertebral centra, must have been very slight.

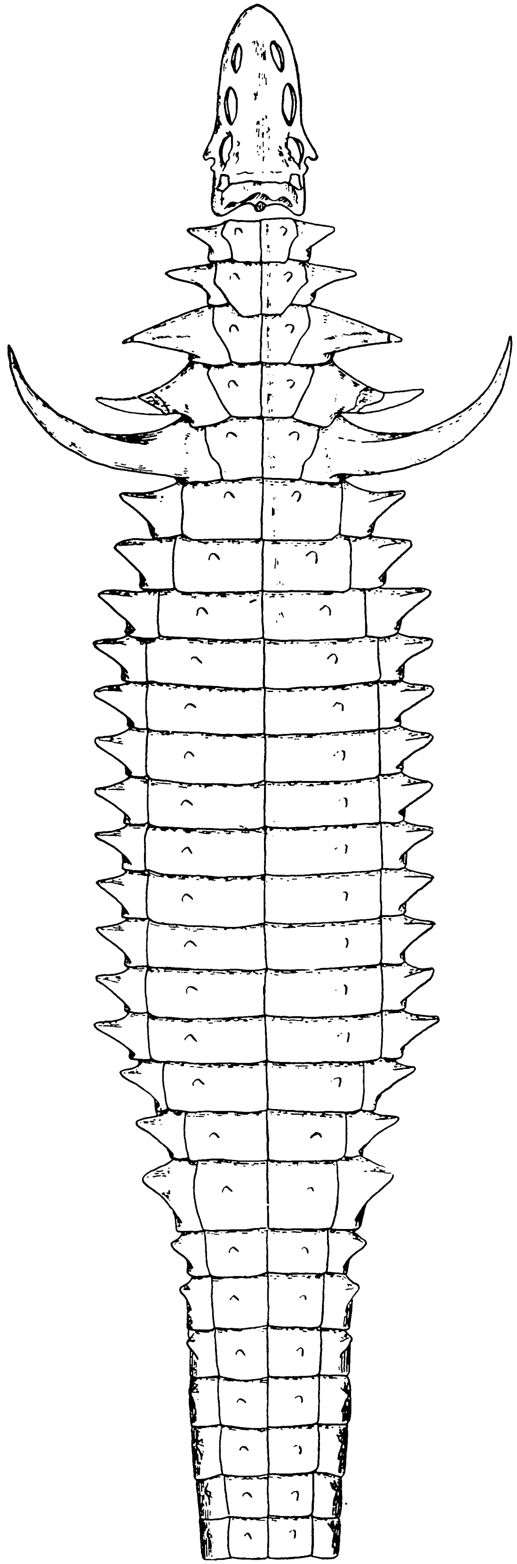

FIG. 4.—Restoration of the dorsal armor of *Desmatosuchus spurensis*, $\times \frac{1}{24}$

Posterior to the fifth arch the median plates become shorter antero-posteriorly and elongate laterally to accommodate the broadening of the back. The lateral plates have a distinctly angular form, the inner half of the base shorter and nearly horizontal, the outer half longer and extending outward and downward at a slight angle. The spines are directed outward and slightly forward. In the pelvic region is placed a broader arch followed by a narrower one; this arrangement is only tentative, but the plates can hardly go elsewhere and it has been pointed out to the author by Professor Alexander Ruthven that such an arrangement of scales and scutes is not uncommon in living forms. Only the anterior portion of the tail is represented and only by plates of the lateral series. It is altogether probable that the median plates gradually disappeared as in the living Crocodilia. The lateral plates have well-developed spines and the outer half of the base is elongated and extends downward almost directly in the same plane as the outer side of the spine, indicating that the sides of the tail were elevated and flattened, not rounded. The length of the tail is uncertain.

The exact position of this peculiar form is undeterminable as yet; its phytosaurian affinities are beyond question, but whether it is to be regarded as a highly specialized form of a more primitive type retaining characters of the primitive single-arched reptiles and placed near the origin of the Parasuchia, or a specialization of a more advanced type, remains to be determined after more complete preparation and the assemblage of the material in a mount. An attempt to obtain more material is in progress.

For this new form, indicating the skull as the characteristic portion of the holotype, I would suggest the name *Desmatosuchus spurensis*, with the family and sub-order *Desmatosuchidae* and *Desmatosuchia*.

ON A NEW SPECIES OF PHYTOSAUR FROM THE DOCKUM TRIASSIC BEDS OF TEXAS

While on a trip through a portion of the Triassic beds of Texas in the summer of 1919 the author was privileged to examine the collection of Mr. George D. Doughty, of Post City, Texas. In this collection is the posterior portion of the skull of a large Phytosaur preserved in a soft yellow clay. The bones are somewhat rotted and broken but, as is common in specimens preserved in such a matrix, the sculpture and the sutures are exquisitely preserved. Mr. Doughty was so kind as to loan this specimen to the author for study and illustration. As preserved and collected, the posterior part of the top of the skull and the left side are present as far forward as the nares and the posterior end of the antorbital opening. The lower part of the skull is lost and the occipital region is represented by a detached fragment. The skull was distorted in fossilization so that the left temporal region is pushed outward at a decided angle. Figures 5 and 6 show the sculpture of the bones and the position of the sutures so clearly that extended description is unnecessary.

The lateral temporal opening is rhomboidal in outline with the long axis inclined obliquely forward and back. Its upper border is formed by the squamosal and postorbital. The squamosal is fairly flat on the upper surface and marked with a low relief of broad rugosities. The descending process on the outer side is smooth and widens toward its connection with the quadrato-jugal. The posterior end is widened and the inferior face is marked by two shallow, elongate, depressions, probably the location of cartilaginous attachment to the opisthotic. Just anterior to these there is a deep pit which received the head of the quadrate. There is a total lack of any descending, hooklike process posterior to the quadrate and defining the otic notch.

The parietals are flat or slightly concave; the posterior ends are broken off but there is clear evidence that the posterior ends were below the level of the squamosals and that there was no elevated arcade defining the posterior border of the upper temporal opening.

The quadrate was erect and its greatest breadth lay almost at right angles to the squamosal and the quadrato-jugal. Its anterior face is sharply concave, the inner border extends more forward than the outer and is very thin; apparently only the lower part of this inner edge united with the pterygoid.

The quadrato-jugal is peculiar in its mode of articulation with the jugal and the squamosal; the anterior and upper edges are split and the lower edge of the squamosal and the posterior edge of the jugal are deeply dovetailed into the quadrato-jugal. This relation is clearly shown by the distinct and perfectly preserved sutures. From this peculiar relation it follows that the quadrato-jugal occupies very nearly as large an area on the inner side of the temporal arch as on the outer, though it forms but a small portion of the posterior lower edge of the temporal opening. The attachment of the quadrato-jugal to the quadrate is by a broad, flat suture, interrupted by a good-sized quadrate foramen.

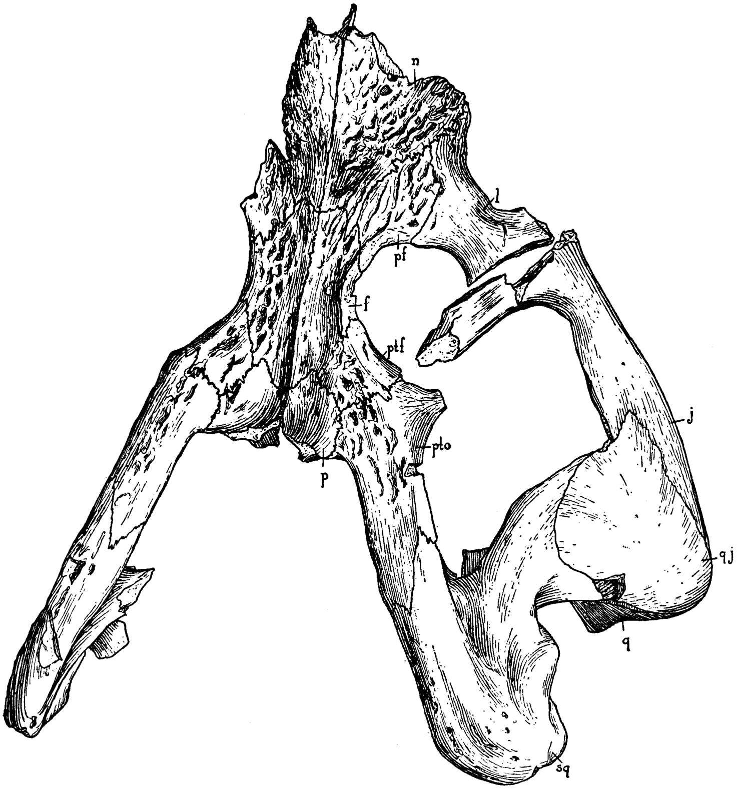

Fig. 5.—Upper view of the skull of *Phytosaurus doughtyi*, $\times\frac{1}{4}$

The jugal extends forward in a nearly straight line, not rising sharply or even bending upward to form a notch below the lateral temporal opening. It is not certain, but possible, that an anterior extension of the jugal took part in the posterior edge of the antorbital opening. On the inner side of the anterior lower angle of the jugal are two articular faces which are separated by a deep groove; this when opposed to the maxillary would form a large foramen.

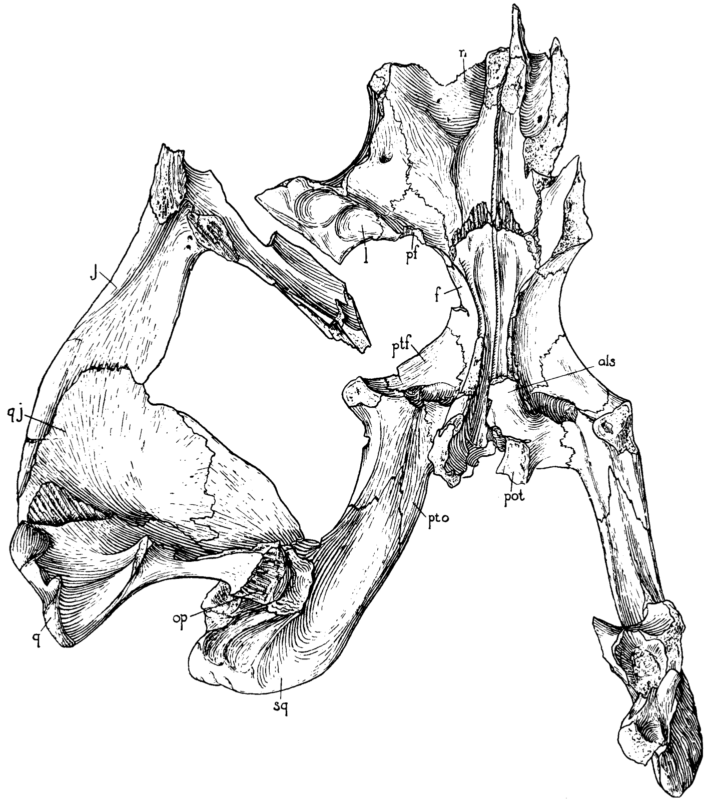

Fig. 6.—Lower view of the skull of *Phytosaurus doughtyi*, ×¼

The orbits are nearly circular and are separated from the lateral temporal opening and the antorbital opening by strong bars. The anterior bar, formed by the lachrymal, is without sculpture but there is no indication of the opening extending backward in a depression on the surface of this bone.

The nasals are nearly flat in their posterior part but rise sharply to the posterior edge of the nares, which open upon a considerable elevation. The nasals are short, not extending, apparently, anterior to the openings, and they do not separate the nares. The septum is formed by thin, paired plates which rise from below, as in most of the Phytosaurs; these are apparently the mesethmoids. The surface of the nasals, together with the surface of the frontals and parietals, are deeply sculptured. The nasal canals extend sharply backward as well as downward.

On the under side of the specimen the walls of the brain case are broken and lost from a line above the otic region. The bones which form the remnant of the brain case extend forward in sharp processes which lie in grooves on the lower surface of the frontals; these are probably the alisspenoids. The channel for the forward extension of the olfactory portion of the brain is well defined. At the point of junction of the postorbital, postfrontal, and parietal there are deep pits, transversely elongate, on either side. The function of these is obscure; they are perhaps connected with the orbitopineal process of the brain described by Cope in the cast of the brain cavity of *Phytosaurus buceros*.[1]

MEASUREMENTS	MM.
Posterior edge of nares to posterior end of squamosal	406.8
Top of squamosal to base of quadrate	233.6
Width across lower face of quadrate	83
Interorbital space, narrowest	62
Center of foramen magnum to end of opisthotic	124.7

A consideration of this brief description and the accompanying figures will show that this specimen differs at least specifically, from any yet described, and the name *Phytosaurus* (*Machaeroprosopus*) *doughtyi* is proposed for it in honor of the discoverer.

From the published figures of *Phytosaurus kapffi* given by v. Huene[2] this specimen differs notably. The quadrate fits into a pit on the lower side of the squamosal and is supported above by the opisthotic and below by the pterygoid; the latter is attached to the lower half of the quadrate and does not appear on the posterior lateral face of the quadrate as suggested in Huene's Figure 15.

[1] *American Naturalist*, Vol. XXII, p. 914.

[2] *Geol. u. Paleontolog. Abhdlg.*, N.F., Bd. X, 1891, Figs. 14–16.

The opisthotic and pterygoid join the quadrate by separate attachments in a manner quite different from that suggested by Huene, Figure 16. From this and all other described Phytosaurs it differs in the absence of a descending hook from the squamosal posterior to the quadrate, outlining the otic notch.

From *Paleorhinus*[1] it differs in the more posterior position of the nares, these lying over the antorbital opening as in the Phytosaurus type rather than anterior to it as in the Mystriosuchus type. The nasals are shorter and do not separate the nares nor extend anterior to them. No otic foramen is present. The quadrate foramen is entirely on the posterior face of the skull. The pre-frontal is much shorter and lies almost entirely anterior to the frontal. The lachrymal is stouter and forms a broad bar between the orbit and the antorbital opening. There is no evidence of a depression extending to the lachrymal from the posterior edge of the antorbital foramen and the lachrymal had little or no connection with the maxillary. The lower edge of the lateral temporal opening is convex upward, not concave.

From *Angistorhinus* it differs in the quadrangular rather than the oval form of the lateral temporal opening; in having the parietal-squamosal arcade depressed; in that the orbits are rounded instead of oval; in the position of the orbits which are more anterior in reference to the lateral temporal opening; in that the parietals meet anteriorly in a recess rather than in a point; and in that the opisthotic is more spatulate at the outer end.

From *Machaeroprosopus* it differs in the greater distance between the center of the orbit and the posterior end of the nares, 74 mm. instead of 40 mm. The nasals do not include nor extend in front of the nares. The frontals are longer and narrower; the jugals probably take little part in the posterior edge of the antorbital foramen. The quadrate foramen is small. The pterygoid is absent but it does not appear that there could have been any extension in the form of a wedge or hook between the quadrate and quadratojugal, as described and figured by Mehl.

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[1] Bibliographies of the American Triassic Phytosaurs are given by McGregor, *Mem. Am. Mus. Nat. Hist.*, Vol. IX (1906), Part XI; and Mehl, *Jour. Geol.*, Vol. XXIII, No. 2, 1915.

From *Phytosaurus buceros* it differs in the more rounded and shorter posterior process of the squamosal. The lateral temporal opening is larger and more quadrangular in outline. The antorbital opening was more rounded at the posterior end. The jugal passes forward in a nearly straight line, not bending sharply upward, to form a notch in the lower border of the temporal opening.

Mehl in his account of the skull of *Machaeroprosopus*[1] has indicated his belief that the form described by him is congeneric with Cope's *Phytosaurus buceros;* but because he agreed with Jaekel that Cope's form is a distinct genus and because Jaekel's name, *Metarhinus,* is preoccupied, he suggested the new name *Machaeroprosopus.* It is far from certain that the European type of Phytosaurus does not occur in North America; Huene has rejected Jaekel's distinction between *Phytosaurus buceros* and the European forms, and to the author it seems very doubtful on present evidence that such a distinction is justified. For this reason he prefers to refer the new species to the genus *Phytosaurs* (*Machaeroprosopus ?*) with Cope's *buceros* and Mehl's *validus* and *gracilis.*

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[1] *Quart. Bull. Univ. Oklahoma,* N.S., 103 (1916), p. 21.